US009139387B2

(12) **United States Patent**
Inoue

(10) **Patent No.: US 9,139,387 B2**
(45) **Date of Patent: Sep. 22, 2015**

(54) **SHEET FEEDING APPARATUS AND IMAGE FORMING APPARATUS**

(71) Applicant: **CANON KABUSHIKI KAISHA**, Tokyo (JP)

(72) Inventor: **Hiroshige Inoue**, Tokyo (JP)

(73) Assignee: **Canon Kabushiki Kaisha**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/950,394**

(22) Filed: **Jul. 25, 2013**

(65) **Prior Publication Data**

US 2014/0054847 A1 Feb. 27, 2014

(30) **Foreign Application Priority Data**

Aug. 23, 2012 (JP) 2012-184434

(51) **Int. Cl.**

B65H 3/52	(2006.01)
B65H 3/06	(2006.01)
G03G 15/00	(2006.01)
B65H 27/00	(2006.01)

(52) **U.S. Cl.**

CPC ***B65H 3/5261*** (2013.01); ***B65H 3/0607*** (2013.01); ***B65H 3/0638*** (2013.01); ***B65H 3/0669*** (2013.01); ***G03G 15/6511*** (2013.01); *B65H 27/00* (2013.01); *B65H 2402/631* (2013.01); *B65H 2403/512* (2013.01); *B65H 2403/732* (2013.01); *B65H 2404/17* (2013.01); *B65H 2404/192* (2013.01); *B65H 2601/524* (2013.01)

(58) **Field of Classification Search**

CPC B65H 27/00; B65H 2401/2311; B65H 2402/35; B65H 2402/34; B65H 2402/341; B65H 2402/631; B65H 2403/10

USPC 271/121

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,358,230	A	10/1994	Ikemori et al.
5,485,991	A	1/1996	Hirano et al.
5,793,399	A	8/1998	Kawakami et al.
5,886,729	A	3/1999	Hiramatsu et al.
5,992,993	A	11/1999	Kiyohara et al.
6,045,220	A	4/2000	Kiyohara et al.

(Continued)

FOREIGN PATENT DOCUMENTS

JP	58082933	A *	5/1983
JP	S61-90935	A	5/1986

(Continued)

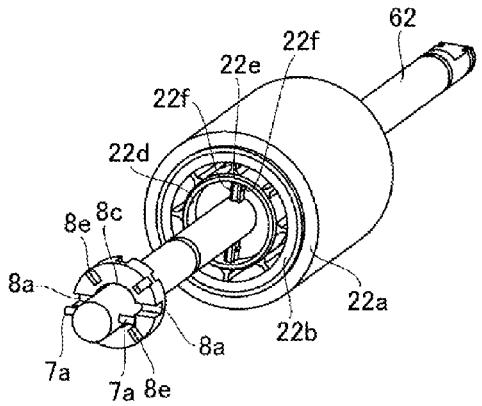
Primary Examiner — Howard Sanders

(74) *Attorney, Agent, or Firm* — Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

There are provided a sheet feeding apparatus which, with a simple configuration, can suppress generation of noise during feeding of a sheet without having an affect on sheet separating performance, and an image forming apparatus which includes this sheet feeding apparatus. The sheet feeding apparatus includes: a feeding roller which feeds a sheet S; a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding apparatus, one by one; a feeding rotational shaft which transmits rotational driving force to the feeding roller; and a roller dumper which is provided between the feeding roller and the feeding rotational shaft, and transmits the rotational driving force from the feeding rotational shaft to the feeding roller, while absorbing vibrations of the feeding roller.

15 Claims, 9 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

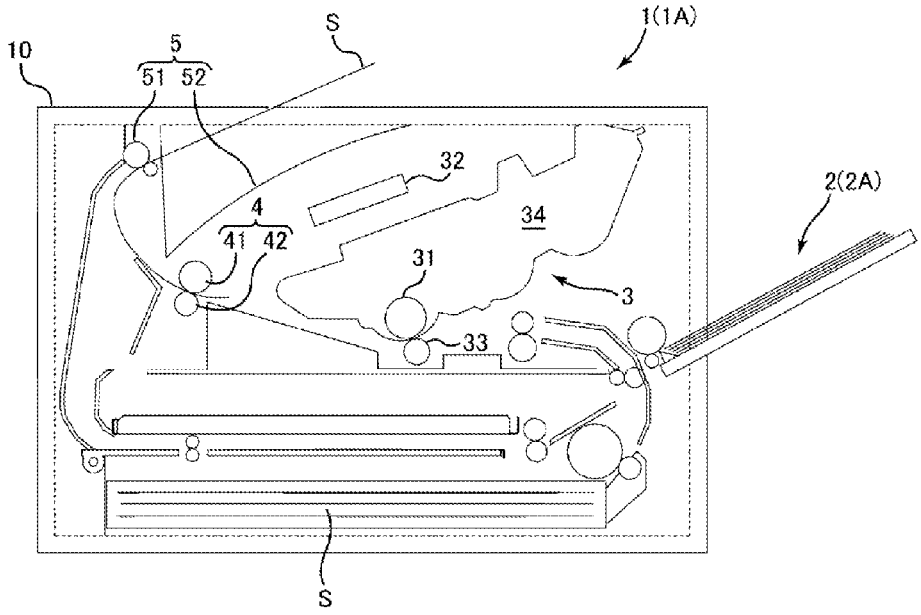
7,048,271	B2 *	5/2006	Sheng et al.	271/121
7,497,433	B2 *	3/2009	Nagao	271/125
8,292,293	B2	10/2012	Inoue	
8,480,081	B2	7/2013	Inoue	
8,550,456	B2	10/2013	Hirota et al.	
2003/0160379	A1 *	8/2003	Shimamura et al.	271/10.01

FOREIGN PATENT DOCUMENTS

JP	H07-172601	A	7/1995
JP	H11-59941	A	3/1999
JP	2003-160243	A	6/2003
JP	2007-015792	A	1/2007
JP	4593389	B2	12/2010
JP	2011-251807	A	12/2011

* cited by examiner

FIG. 1



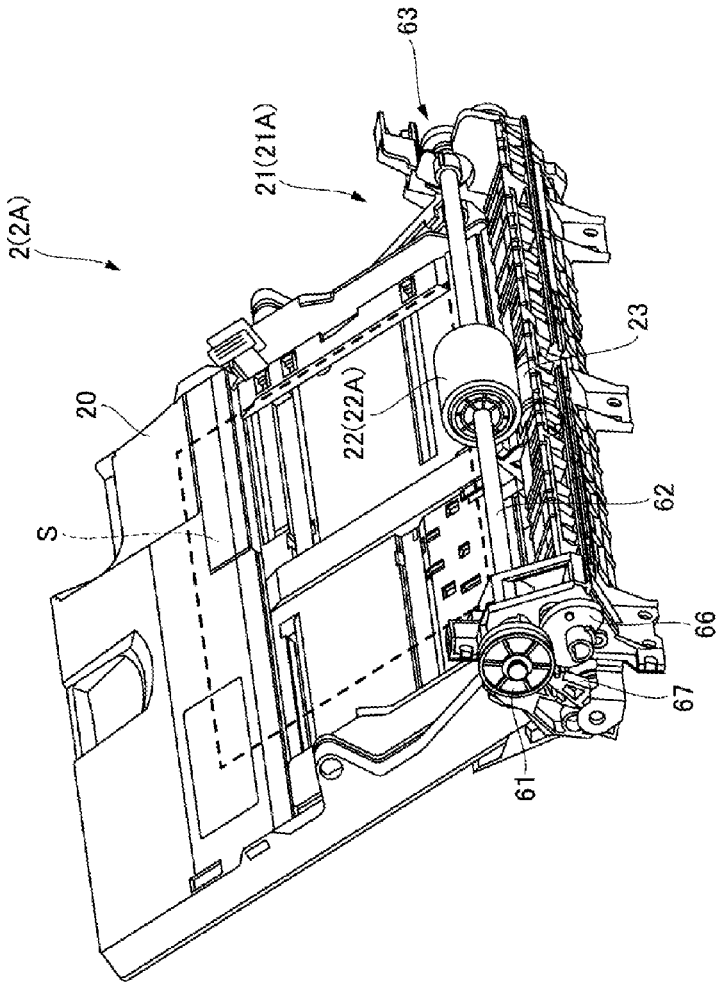


FIG. 2

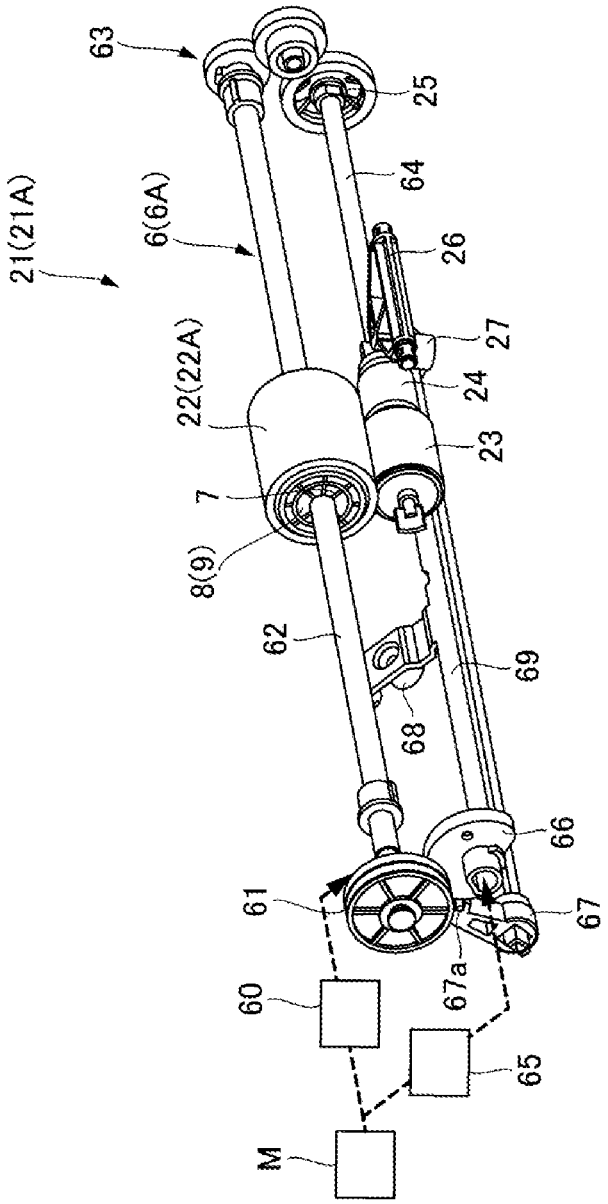

63
25
64
21(21A)
6(6A)
26
27
24
22(22A)
23
7
8(9)
62
69
68
66
61
67
67a
60
65
M

FIG. 3

FIG. 4

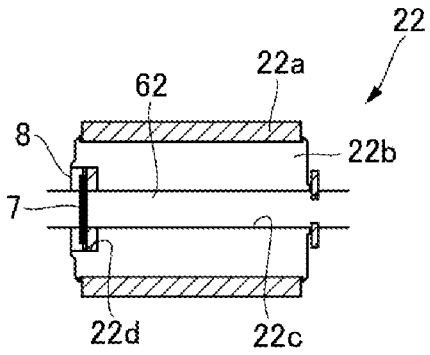


FIG. 5A

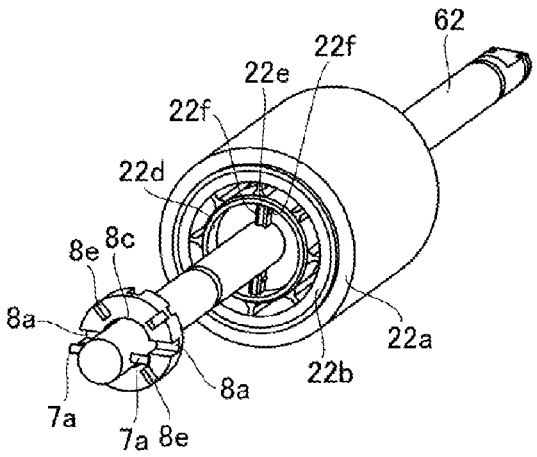


FIG. 5B

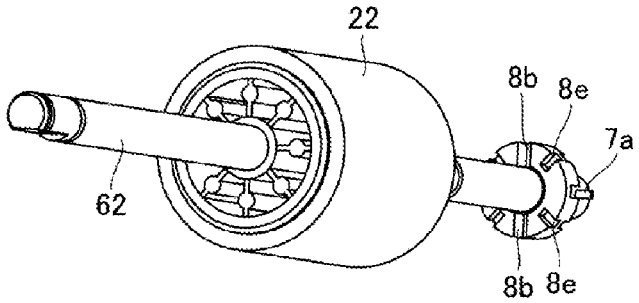


FIG. 6A

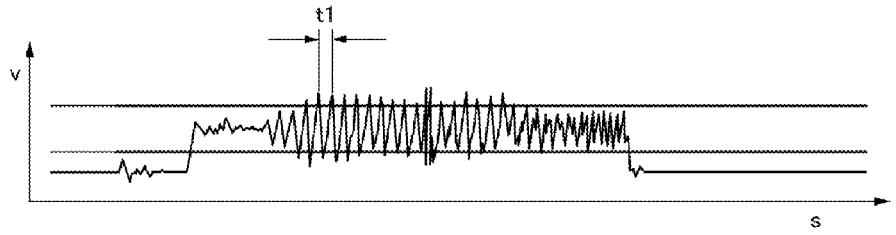


FIG. 6B

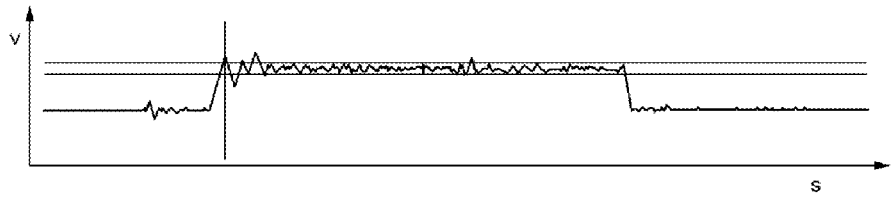


FIG. 6C

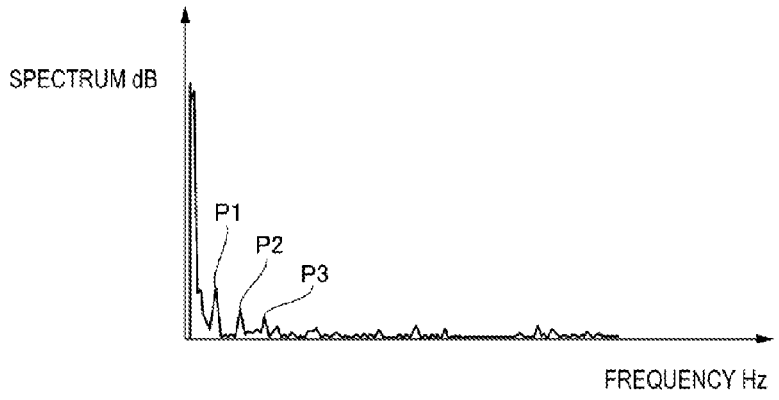


FIG. 6D

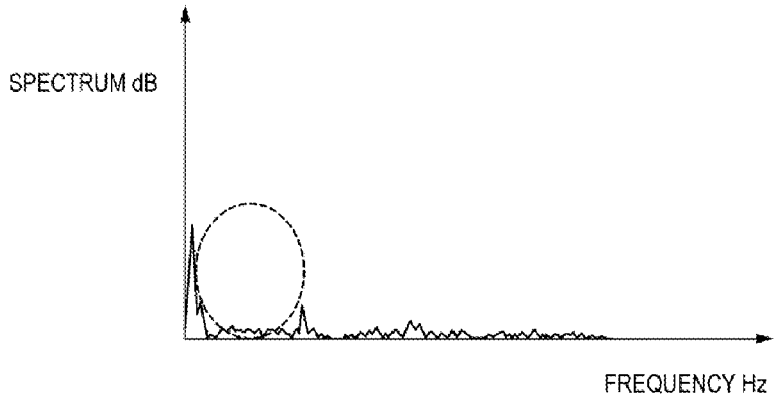


FIG. 7

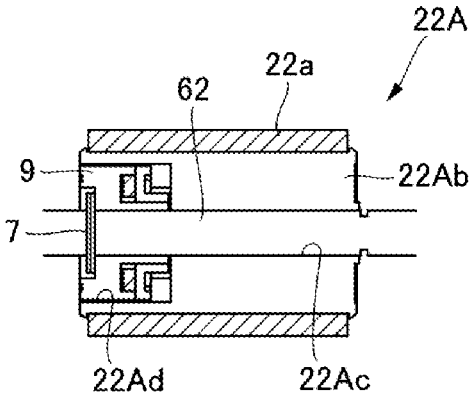


FIG. 8A

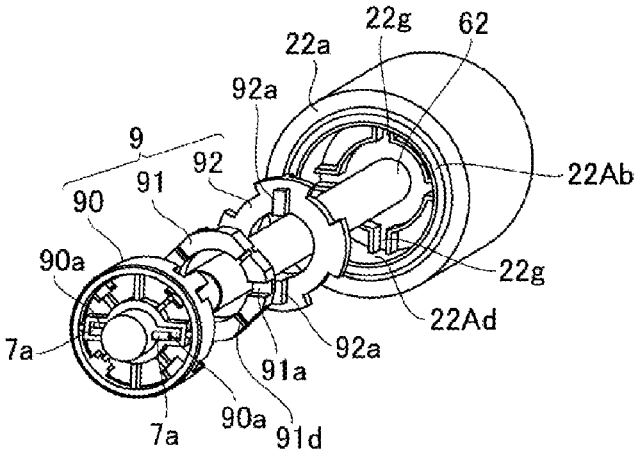
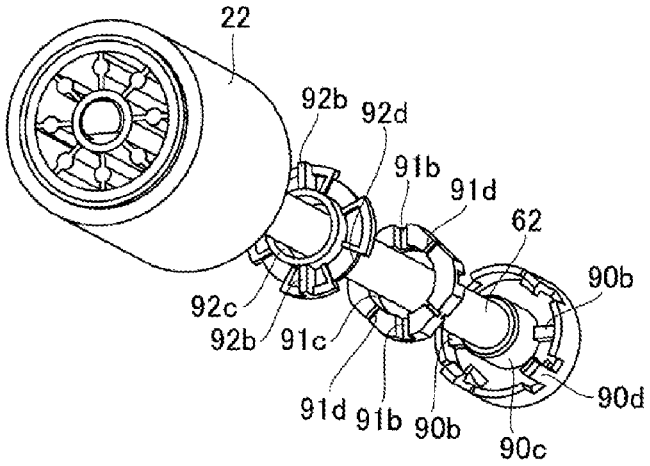

22g
62
22a
92a
9
92
91
90
22Ab
90a
22g
22Ad
7a
92a
91a
90a
91d
7a

FIG. 8B


22
92b
92d
91b
91d
62
90b
92c
92b
91c
90d
91d
91b
90b
90c

SHEET FEEDING APPARATUS AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a sheet feeding apparatus which feeds a sheet, and an image forming apparatus including the sheet feeding apparatus.

2. Description of the Related Art

There has hitherto been known an image forming apparatus including a sheet feeding apparatus which automatically feeds sheets, stored in a sheet tray for storing sheets, one by one toward an image forming portion. The sheet feeding apparatus is provided with a feeding roller for feeding the uppermost sheet stored in the sheet tray, and a separation roller for separating sheets being multiply fed. By means of the feeding roller and the separation roller, the apparatus separates the sheets, stored in the sheet tray, one by one and feeds each separated sheet to the image forming portion.

For separation of the sheets, the separation roller is pressed against the feeding roller, while being applied via a torque limiter with rotational drive to rotate in a reverse direction to a feeding direction. Therefore, for example, when two or more sheets are fed by the feeding roller, since friction force between the sheets is smaller than friction force between the separation roller and the sheet, the separation roller rotates in the reverse direction to the feeding direction, to bring back second and subsequent sheets. On the other hand, when one sheet is fed by the feeding roller, rotational drive is blocked off by the torque limiter, and the separation roller rotates as driven by the feeding roller, to feed the sheet.

However, after the second and subsequent sheets have been brought back by the separation roller, the separation roller may be pulled by the first sheet and may thus repeat the aforementioned reverse rotation and driven rotation. When these rotational operations are repeated at a high speed, vibrations of the feeding roller and the like might be generated to cause generation of noise.

In order to deal with this, there has been proposed a sheet feeding apparatus in which a pressing member is pressed against a rotational shaft of the feeding roller to suppress vibrations so as to reduce generation of noise during feeding of sheets (refer to Japanese Patent Laid-Open No. 2003-160243).

Moreover, there has been proposed a configuration in which a sheet guide is movably provided in a projecting position where a sheet is guided between a feeding roller and a pair of conveying rollers and in a retreat position where feeding of sheets is not prevented (refer to Japanese Patent Laid-Open No. 2011-251807). According to this configuration, the sheet guide is moved to the projecting position when a sheet is pulled out by the conveying roller, thereby to switch a sheet conveying direction so as to reduce vibrations.

However, in the case of pressing the pressing member against the rotational shaft of the feeding roller to suppress vibrations, there is required a large-sized driving motor serving to increase a driving torque for driving the feeding roller so that an extra load is generated at the rotational shaft. Moreover, in the case of switching the sheet conveying direction at the time of pulling out the sheet to suppress vibrations, a switching mechanism for switching the conveying direction is required, which has been problematic.

Accordingly, it is desirable to provide a sheet feeding apparatus which, with a simple configuration, can suppress generation of noise during feeding of sheets without having an affect on sheet separating performance, and an image forming apparatus which includes this sheet feeding apparatus.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a sheet feeding apparatus including: a feeding roller which feeds a sheet; a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding apparatus, one by one; a feeding rotational shaft which transmits rotational driving force to the feeding roller; and a vibration absorbing member which is provided between the feeding roller and the feeding rotational shaft, and transmits the rotational driving force from the feeding rotational shaft to the feeding roller, while absorbing vibrations of the feeding roller.

According to the present invention, it is possible to provide a sheet feeding apparatus in which a vibration absorbing member is provided between a feeding roller and a feeding rotational shaft and which, with the simple configuration, can suppress generation of noise during feeding of sheets without having an affect on sheet separating performance, and provide an image forming apparatus which includes this sheet feeding apparatus.

Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view schematically illustrating an overall structure of an image forming apparatus according to an embodiment of the present invention;

FIG. **2** is a perspective view illustrating a sheet feeding apparatus according to the present embodiment;

FIG. **3** is a perspective view illustrating a separation feeding unit in a sheet feeding apparatus according to the present embodiment;

FIG. **4** is a sectional view of a feeding roller in a sheet feeding apparatus according to a first embodiment;

FIGS. **5**A and **5**B are perspective views illustrating a roller dumper in a sheet feeding apparatus according to the first embodiment;

FIGS. **6**A to **6**D are diagrams for describing a vibration preventing effect of the sheet feeding apparatus according to a first embodiment;

FIG. **7** is a sectional view of a feeding roller in a sheet feeding apparatus in an image forming apparatus according to a second embodiment; and

FIGS. **8**A and **8**B are perspective views illustrating a dumper unit in a sheet feeding apparatus according to the second embodiment.

DESCRIPTION OF THE EMBODIMENTS

Hereinafter, an image forming apparatus including a sheet conveying portion according to each of embodiments of the present invention will be described with reference to the drawings. The image forming apparatus according to each of the embodiments of the present invention is an image forming apparatus including a sheet feeding apparatus which separates sheets one by one, such as a copying machine, a printer, a facsimile machine, and a complex apparatus of these. In each of the following embodiments, a description will be

given using an electrophotographic image forming apparatus (hereinafter simply referred to as "image forming apparatus").

First Embodiment

An image forming apparatus **1** according to a first embodiment of the present invention will be described with reference to FIGS. **1** to **6**A to **6**D. First, a schematic configuration of the image forming apparatus **1** according to the first embodiment will be described with reference to FIG. **1**. FIG. **1** is a sectional view schematically illustrating an overall structure of the image forming apparatus **1** according to the embodiment of the present invention.

As illustrated in FIG. **1**, the image forming apparatus **1** includes a sheet feeding apparatus **2** which feeds a sheet S, an image forming portion **3** which forms an image on the sheet S, a fixing portion **4** which fixes an image on the sheet S, and a discharge portion **5** which discharges the sheet S fixed with the image.

The sheet feeding apparatus **2** separates sheets one by one, and feeds each separated sheet to the image forming portion **3**. It is to be noted that the sheet feeding apparatus **2** will be described in detail later.

The image forming portion **3** is provided downstream of the sheet feeding apparatus **2** in a sheet feeding direction (hereinafter simply referred to as "downstream"), and includes a photosensitive drum **31** which forms a toner image, and a charger (not illustrated) which uniformly charges the surface of the photosensitive drum **31**. Further, the image forming portion **3** includes an exposure portion **32** which irradiates the photosensitive drum **31** with laser light to form an electrostatic latent image thereon, a developing portion (not illustrated) which visualizes the electrostatic latent image on the photosensitive drum **31** as a toner image, and a cleaning portion (not illustrated) which collects the residual toner. Moreover, the image forming portion **3** is provided with a transfer roller **33** which is pressed against the photosensitive drum **31** to form a transfer nip. It should be noted that in the present embodiment, the photosensitive drum **31**, the charger, the developing portion and the cleaning portion are unitized, and then detachably configured in an apparatus body **10** as a process cartridge **34**.

The fixing portion **4** is provided downstream of the image forming portion **3** in a sheet conveying direction (hereinafter simply referred to as "downstream"), and includes a fixing roller **41** having a heater built therein, and a pressure roller **42** which is pressed against the fixing roller **41**. The discharge portion **5** is provided downstream of the fixing portion **4**, and includes a pair of discharge rollers **51** which discharge a sheet from the inside of the apparatus body, and a discharge tray **52** which loads the discharged sheets.

Subsequently, the sheet feeding apparatus **2** according to the first embodiment will be specifically described with reference to FIGS. **2** to **5**A and **5**B in addition to FIG. **1**. FIG. **2** is a perspective view illustrating the sheet feeding apparatus **2** according to the present embodiment. FIG. **3** is a perspective view illustrating a separation feeding unit **21** in the sheet feeding apparatus **2** according to the present embodiment. FIG. **4** is a sectional view of a feeding roller **22** in the sheet feeding apparatus **2** according to the first embodiment. FIGS. **5**A and **5**B are perspective views illustrating a roller dumper **8** in the sheet feeding apparatus **2** according to the first embodiment.

As illustrated in FIG. **2**, the sheet feeding apparatus **2** is provided with a sheet tray **20** which loads the sheets S, and the separation feeding unit **21** which separates and feeds the sheets S loaded in the sheet tray **20**.

The sheet tray **20** is provided with a lifting/lowering mechanism (not illustrated) which is capable of freely lifting and lowering the loaded sheets S, and at the time of feeding the sheets S, the lifting/lowering mechanism lifts the sheets S so as to press the uppermost sheet of the stored sheets S against the after-mentioned feeding roller **22**.

As illustrated in FIG. **3**, the separation feeding unit **21** is provided with the feeding roller **22** which feeds the sheets stored in the sheet tray **20** toward the image forming portion **3**, a separation roller **23** which separates the sheets S, fed by the feeding roller **22**, one by one, and a torque limiter **24**. Further, the separation feeding unit **21** is provided with a driving motor M for rotating the feeding roller **22** and the separation roller **23**, and a drive transmission mechanism **6** which transmits driving force from the driving motor M to the feeding roller **22** and the separation roller **23**.

As illustrated in FIG. **4**, the feeding roller **22** is provided with a rubber roller portion **22***a* which is pressed against the uppermost sheet S stored in the sheet tray **20** to feed it, and a color portion **22***b* which supports the rubber roller portion **22***a*. The color portion **22***b* is provided with a shaft bearing portion **22***c* which rotatably supports an after-mentioned feeding rotational shaft **62**, and a dumber storing portion **22***d* which is fitted with the after-mentioned roller dumper **8** to store the roller dumper **8**. Further, as illustrated in FIG. **5**, the dumber storing portion **22***d* is provided with drive transmission ribs **22***e*, **22***e* which are engaged with after-mentioned drive transmission grooves **8***b*, **8***b* of the roller dumper **8**. The drive transmission rib **22***e* is provided with dropping preventive projections **22***f*, **22***f* which are pressed into the drive transmission groove **8***b* so as to prevent the roller dumper **8** from dropping.

The separation roller **23** is pressed against the feeding roller **22** to form a nip portion with the feeding roller **22**, and when a plurality of sheets is fed by the feeding roller **22**, the separation roller **23** rotates in the reverse direction to the feeding direction, to separate the plurality of sheets S one by one and feed only the uppermost sheet S. Specifically, the separation roller **23** is applied with rotational drive in the reverse direction to the feeding direction via the torque limiter **24**. When one sheet S is sent to the nip portion, the drive is blocked off by the torque limiter **24**, and the separation roller **23** rotates as driven by the feeding roller **22**. On the other hand, when two or more sheets S are sent to the nip portion, since a coefficient of friction between the sheets is smaller than a coefficient of friction between the separation roller **23** and the sheet S, the separation roller **23** rotates in the reverse direction to the feeding direction, to pull second and subsequent sheets back. Moreover, the separation roller **23** is swingably supported by a separation roller pressurizing arm **26** and a separation roller pressurizing spring **27** with a swinging fulcrum taken as a roller shaft bearing **25**, and is pressed against the feeding roller **22**.

The drive transmission mechanism **6** is provided with a feeding clutch **60** connected to the driving motor M, a feeding gear **61** connected to the feeding clutch **60**, the feeding rotational shaft **62** connected to the feeding gear **61**, a pin **7** having been pressed into the feeding rotational shaft **62**, and the roller dumper **8** as a vibration absorbing member. Via these, the drive transmission mechanism **6** transmits rotational driving force of the driving motor M to the feeding roller **22**, to rotate the feeding roller **22** in the feeding direction.

Herein, as illustrated in FIG. **5**A, the roller dumper **8** is formed in a shape of an elastically transformable substantially circular plate, and, for example, it can be an elastic

member formed of a viscoelastic material, namely a rubber material, with a rubber hardness of degree 30° to 60°.

Further, as illustrated in FIG. **5**B, one surface of the roller dumper **8** is formed with the drive transmission grooves **8***b*, **8***b* fittable with the drive transmission ribs **22***e*, **22***e* of the feeding roller **22** as fitting portions, and a plurality of transformed grooves **8***e*. The drive transmission ribs **22***e*, **22***e* are formed so as to extend in a radial direction from the center of rotation of the feeding roller **22**, and the drive transmission grooves **8***b*, **8***b* are also formed so as to extend from the radial direction from the center. The roller dumper **8** can absorb vibrations of the feeding roller **22** by the drive transmission ribs **22***e*, **22***e* being elastically transformed at the time of being fitted with the drive transmission grooves **8***b*, **8***b*, and can more effectively absorb vibrations of the feeding roller **22** by the plurality of transformed grooves **8***e* being transformed. Similarly, the other-side surface of the roller dumper **8** is formed with drive transmission grooves **8***a*, **8***a*, which are fitted with tip portions **7***a*, **7***a* of the pin **7** having been pressed into the feeding rotational shaft **62**, and the plurality of transformed grooves **8***e*. The drive transmission grooves **8***a*, **8***a* are elastically transformed at the time of being fitted with the tip portions **7***a*, **7***a* of the pin **7**, whereby the roller dumper **8** absorbs vibrations of the feeding roller **22** so as to prevent the vibrations from transmitting to the feeding rotational shaft **62** via the pin **7**. The plurality of transformed grooves **8***e* is then transformed, thereby to make vibrations of the feeding roller **22** efficiently absorbable.

Further, the roller dumper **8** is formed with a through hole **8***c*, through which the feeding rotational shaft **62** is allowed to pass, such that a space is provided between the through hole **8***c* and the feeding rotational shaft **62**, and by providing the space, it is possible to block off vibrations in a rotating direction between the feeding roller **22** and the feeding rotational shaft **62**.

Moreover, the drive transmission mechanism **6** is provided with a gear train **63** as a drive transmitting unit connected to the feeding rotational shaft **62**, and a separation rotational shaft **64** which is connected to the gear train **63** and connected to the separation roller **23** via the torque limiter **24**. That is, the gear train **63** is provided between the feeding rotational shaft **62** and the separation rotational shaft **64**. Via these, the drive transmission mechanism **6** transmits rotational driving force of the driving motor M to the separation roller **23**, and transmits rotational force to the separation roller **23** in the reverse direction to the feeding direction.

Moreover, the drive transmission mechanism **6** is provided with a tray clutch **65** connected to the driving motor M, a lifting/lowering cam **66** connected to the tray clutch **65**, a lifting/lowering arm **67** interlocked with the lifting/lowering cam **66**, and a tray pressurized arm **69** pressurized by a tray pressurizing spring **68**. Via these, the drive transmission mechanism **6** converts the rotational driving force of the driving motor M to a vertical operation, to drive the lifting/lowering mechanism of the sheet tray **20**. Specifically, pressure is applied to or released from the feeding roller **22** of the sheet tray **20** by the vertical operation of the tray pressurized arm **69**. Further, a sensor (not illustrated) is fixed to the lifting/lowering cam **66**, and a rotational phase of the lifting/lowering cam **66** is detected by the sensor, to perform on/off control of the tray clutch **65**, whereby pressure is applied to or released from the feeding roller **22**. It is to be noted that a roller **67***a* is fixed to the tip of the lifting/lowering arm **67**, and the roller **67***a* reduces a drive transmission loss.

Next, a vibration preventive effect of the sheet feeding apparatus **2** in the image forming apparatus **1** according to the first embodiment will be described with reference to FIGS. **6**A to **6**D. FIGS. **6**A to **6**D are diagrams for describing a vibration preventing effect of the sheet feeding apparatus **2** according to the first embodiment.

FIGS. **6**A and **6**B illustrate a surface speed waveform (vibration waveform) of the feeding roller **22** in the rotating direction, where a horizontal axis indicates time (s) and a vertical axis indicates a surface speed (v) of the feeding roller **22**.

FIG. **6**A illustrates a vibration waveform of a conventional feeding roller in the rotating direction, illustrating a case where sheets are fed in a bunch to the nip portion between the feeding roller and the separation roller, and vibrations of a second sheet are propagated to the feeding roller, causing vibrations of the feeding roller at tens Hz and generation of noise. On the other hand, FIG. **6**B illustrates a vibration waveform of the feeding roller **22** according to the first embodiment in the rotating direction, illustrating a case where, even when sheets are fed in a bunch to the nip portion between the feeding roller **22** and the separation roller, vibrations of the second sheet are not propagated to the feeding roller, not causing generation of noise.

As illustrated in FIGS. **6**A and **6**B, in the conventional feeding roller, when sheets are fed in a bunch to the nip portion, the second sheet vibrates to generate noise, but by providing the roller dumper **8**, transmission of vibrations of the second sheet to the feeding roller **22** is suppressed, to allow reduction in noise.

FIGS. **6**C and **6**D illustrate spectrums dB of noise generated at the time of feeding sheets, where a horizontal axis indicates a frequency (Hz) and a vertical axis indicates a spectrum (dB). FIG. **6**C is the case of using the conventional feeding roller, illustrating a frequency spectrum of noise at the time when vibrations of the feeding roller in the rotating direction are being generated as in FIG. **6**A. Herein, an amplitude t1 illustrated in FIG. **6**A and a peak frequency P1 of a first noise illustrated in FIG. **6**C is in a relationship of P1=1/t1.

Further, peak frequencies P2 and P3 of second and third noises illustrated in FIG. **6**C are integral multiples of the peak frequency P1 of the first noise. On the other hand, FIG. **6**D is the case of using the roller dumper, and illustrates a frequency spectrum dB at the time when rotational vibrations of the feeding roller **22** in the rotating direction have been stopped as illustrated in FIG. **6**B. In FIG. **6**D, the peak frequencies P1, P2, P3 of the first to third noises illustrated in FIG. **6**C are not present, and hence it is found that the noise has been reduced.

As thus described, the roller dumper **8** for suppressing vibrations is provided between the feeding rotational shaft **62** and the feeding roller **22**, thereby allowing suppression of noise associated with separation and feeding of sheets, without affecting sheet separation performance and a load on a sheet feeding drive. Further, since the configuration formed only by providing the roller dumper **8**, it is possible to suppress noise without making the configuration of the sheet feeding apparatus complex.

Second Embodiment

Next, an image forming apparatus **1**A according to a second embodiment of the present invention will be described with reference to FIGS. **7**, **8**A, and **8**B. The image forming apparatus **1**A according to the second embodiment is different from the first embodiment in a roller dumper in a sheet feeding apparatus **2**A. For this reason, in the second embodiment, a description will be given with a focus on the different respect from the first embodiment, namely the roller dumper, and descriptions of similar configurations to those of the first

embodiment are provided with the same numerals and descriptions thereof are omitted.

FIG. **7** is a sectional view of a feeding roller **22**A in the sheet feeding apparatus **2**A in the image forming apparatus **1**A according to the second embodiment. FIGS. **8**A and **8**B are perspective views illustrating a dumper unit **9** in the sheet feeding apparatus **2**A according to the second embodiment.

As illustrated in FIG. **1**, the image forming apparatus **1**A is provided with the sheet feeding apparatus **2**A, the image forming portion **3**, the fixing portion **4** and the discharge portion **5**. As illustrated in FIG. **2**, the sheet feeding apparatus **2**A is provided with the sheet tray **20** and a separation feeding unit **21**A. As illustrated in FIG. **3**, the separation feeding unit **21**A is provided with the feeding roller **22**A, the separation roller **23**, the torque limiter **24**, the driving motor M, and a drive transmission mechanism **6**A.

As illustrated in FIG. **7**, the feeding roller **22**A is provided with the rubber roller portion **22***a*, and a color portion **22**Ab which supports the rubber roller portion **22***a*. The color portion **22**Ab is provided with a shaft bearing portion **22**Ac which supports the feeding rotational shaft **62**, and a dumper storing portion **22**Ad which is engaged with the after-mentioned dumper unit **9** to store it. As illustrated in FIGS. **8**A and **8**B, the dumper storing portion **22**Ad is provided with drive transmission grooves **22***g*, **22***g* which are fitted with after-mentioned drive transmission ribs **92***b*, **92***b* of the dumper unit **9**.

The drive transmission mechanism **6**A is provided with the feeding clutch **60**, the feeding gear **61**, the feeding rotational shaft **62**, the pin **7**, and the dumper unit **9**. Via these, the drive transmission mechanism **6**A transmits rotational driving force of the driving motor M to the feeding roller **22**A, to rotate the feeding roller **22**A in the feeding direction.

The dumper unit **9** is configured including a first dumper color **90**, an elastically transformable feeding roller dumper **91**, and a second dumper color **92**. The first dumper color **90** has a shaft bearing portion **90***c* which rotatably supports the feeding rotational shaft **62**, and the one-side surface of the first dumper color **90** is formed with drive transmission grooves **90***a*, **90***a*, which are fitted with the tip portions **7***a*, **7***a* of the pin **7** having been pressed into the feeding rotational shaft **62**. Further, the other surface of the first dumper color **90** is formed with drive transmission ribs **90***b*, **90***b*, which are fitted with a feeding roller dumper **91**.

The feeding roller dumper **91** is arranged on the other surface side of the first dumper color **90**, and has a shaft bearing portion **91***c* engaged with the shaft bearing portion **90***c* of the first dumper color **90**. Further, the one-side surface of the feeding roller dumper **91** is formed with drive transmission ribs **91***a*, **91***a*, which are fitted with the drive transmission ribs **90***b*, **90***b* of the first dumper color **90**, and transformed grooves **91***d*, **91***d*. Moreover, the other-side surface of the feeding roller dumper **91** is formed with drive transmission grooves **91***b*, **91***b*, which are fitted with the second dumper color **92**, and the transformed grooves **91***d*, **91***d*.

The second dumper color **92** is arranged on the other surface side of the feeding roller dumper **91**, and has a shaft bearing portion **92***c* engaged with the shaft bearing portion **90***c* of the first dumper color **90**. Further, the one-side surface of the second dumper color **92** is formed with drive transmission ribs **92***a*, **92***a*, which are fitted with the drive transmission ribs **91***b*, **91***b* of the feeding roller dumper **91**. Moreover, the other-side surface of the second dumper color **92** is formed with drive transmission ribs **92***b*, **92***b*, which are fitted with the drive transmission ribs **22***g*, **22***g* of the feeding roller **22**A.

Furthermore, the dumper unit **9** is integrated by arranging the feeding roller dumper **91** between the first dumper color **90** and the second dumper color **92** and locking four locking projections **90***d* of the first dumper color **90** to four locked portions **92***d* of the second dumper color **92**.

As thus described, the feeding roller dumper **91** of the dumper unit **9** is elastically transformed, thereby to absorb vibrations in the rotating direction, and a plurality of transformed grooves **91***d* is transformed, thereby to further effectively absorb vibrations. This can result in suppression of vibrations in the rotating direction between the feeding roller **22**A and the feeding rotational shaft **62**. Further, with the dumper being unitized, for example, it needs not be exchanged simultaneously with the feeding roller **22**A as a consumable component, thereby allowing reduction in service cost as well as running cost.

While the embodiments of the present invention have been described above, the present invention is not restricted thereto. Further, the effects described in the embodiments of the present invention are only the most preferred effects resulting from the present invention, and the effects of the present invention are not restricted to those described in the embodiments thereof.

For example, while the description was given using the roller dumper **8** (dumper unit **9**) as the vibration absorbing member in the present embodiment, the present invention is not restricted thereto. The vibration absorbing member may, for example, be configured to be provided with one or more than one soft-viscous vibration-proof members (for example, vibration-proof rubber, etc.).

Moreover, while the description has been given in the present embodiment using the gear train **63** as the drive transmitting unit for converting the rotational driving force of the driving motor M to rotational driving force in the reverse direction to the feeding direction and transmitting the converted force to the separation rotational shaft **64**, the present invention is not restricted thereto. The drive transmitting unit may, for example, be configured such that the rotational driving force is transmittable by a belt.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all modifications, equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2012-184434, filed Aug. 23, 2012, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A sheet feeding apparatus, comprising:

a feeding roller which feeds a sheet;

a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding roller, one by one;

a feeding rotational shaft which rotatably supports the feeding roller and to which is transmitted a rotational driving force from a driving motor; and

a vibration absorbing portion which includes an elastic member formed of a rubber material and formed in a plate shape, wherein one surface of the plate shape of the elastic member has a first connected portion that is connected with a connect portion provided on the feeding roller and a side surface of the plate shape of the elastic member has a second connected portion that is connected with a connect portion provided on the feeding rotational shaft, and the vibration absorbing portion transmits the rotational driving force from the feeding

rotational shaft to the feeding roller, while absorbing vibrations of the feeding roller by an elastic transformation of the rubber material.

2. The sheet feeding apparatus according to claim **1**, wherein

the elastic member has a through-hole through which the feeding rotational shaft is passed such that a space is provided between the through-hole and the feeding rotational shaft and is elastically transformable in a rotating direction of the feeding roller.

3. The sheet feeding apparatus according to claim **1**, further comprising:

a separation rotational shaft which rotates the separation roller; and

a drive transmitting unit which is provided between the feeding rotational shaft and the separation rotational shaft, and converts rotational driving force of the driving motor to rotational driving force in a reverse direction to the feeding direction, and transmits the converted force to the separation rotational shaft.

4. An image forming apparatus, comprising:

the sheet feeding apparatus according to claim **1**; and

an image forming portion which forms an image on a sheet fed by the sheet feeding apparatus.

5. The sheet feeding apparatus according to claim **1**,

wherein the first connected portion is connected with the connect portion of the feeding roller by an engaging a protrusion formed in a radial direction from a center of rotation of the feeding rotational shaft with a groove formed in a radial direction from the center of rotation of the feeding rotational shaft.

6. The sheet feeding apparatus according to claim **1**,

wherein the second connected portion is a groove formed on the elastic member in a radial direction from the center of rotation of the feeding rotational shaft and the connect portion is a pin fixed to the feeding rotational shaft to be engaged with the groove.

7. A sheet feeding apparatus comprising: a feeding roller which feeds a sheet;

a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding roller, one by one;

a feeding rotational shaft which rotatably supports the feeding roller and is transmitted a rotational driving force from a driving motor; and

a vibration absorbing portion which includes an elastic member and absorbs vibrations of the feeding roller while transmitting the rotational driving force from the feeding rotational shaft to the feeding roller,

wherein the elastic member is formed in a shape of a substantially circular plate, and the elastic member has a through-hole through which the feeding rotational shaft is passed, a first connected portion that is connected with a connect portion provided on the feeding roller and a second connected portion that is connected with a connect portion provided on the feeding rotational shaft, and

the first connected portion is connected with the connect portion of the feeding roller by engaging a protrusion formed in a radial direction from a center of rotation of the feeding rotational shaft with a groove formed in the radial direction from the center of rotation of the feeding rotational shaft.

8. The sheet feeding apparatus according to claim **7**, wherein

the connect portion provided on the feeding rotational shaft is a pin fixed to the feeding rotational shaft and the second connected portion provided on the elastic member is a groove formed in a radial direction from the center of rotation of the feeding rotational shaft to be engaged with the pin.

9. An image forming apparatus, comprising:

the sheet feeding apparatus according to the claim **7**; and

an image forming portion which forms an image to the sheet fed from the sheet feeding apparatus.

10. A sheet feeding apparatus comprising a feeding roller which feeds a sheet;

a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding roller, one by one;

a feeding rotational shaft which rotatably supports the feeding roller and is transmitted a rotational driving force from a driving motor; and

a vibration absorbing portion which includes an elastic member which is elastically transformable in a rotating direction of the feeding roller, a first dumping collar provided on the feeding rotational shaft and a second dumping collar provided on the feed roller, and

wherein the elastic member is connected with each of the first dumping collar and the second dumping collar.

11. An image forming apparatus, comprising:

the sheet feeding apparatus according to the claim **10**; and

an image forming portion which forms an image to the sheet fed from the sheet feeding apparatus.

12. A sheet feeding apparatus, comprising:

a feeding roller which feeds a sheet;

a separation roller which is pressed against the feeding roller and rotates in a reverse direction to a direction of feeding by the feeding roller to separate sheets, fed by the sheet feeding apparatus, one by one;

a feeding rotational shaft which rotatably supports the feeding roller and is transmitted a rotational driving force from a motor; and

a vibration absorbing portion which has an elastic member made of rubber material which is connected with each of the feeding roller and the feeding rotational shaft, and transmits the rotational driving force from the feeding rotational shaft to the feeding roller through the rubber material of the vibration absorbing member,

wherein the elastic member has a connected portion that is connected with a connect portion provided on the feeding roller and the connected portion is a groove formed in a radial direction from the center of rotation of the feeding rotational shaft to be engaged with a pin fixed to the feeding rotational shaft.

13. The sheet feeding apparatus according to claim **12**, further comprising;

a connected portion provided on the elastic member is connected with a connect portion of the feeding roller by engaging a protrusion formed in a radial direction from a center of rotation of the feeding rotational shaft with a groove formed in the radial direction from the center of rotation of the feeding rotational shaft.

14. The sheet feeding apparatus according to claim **12**, wherein

the elastic member has a through-hole through which the feeding rotational shaft is passed such that a space is provided between the through-hole and the feeding rotational shaft and is elastically transformable in a rotating direction of the feeding roller.

15. An image forming apparatus, comprising:

the sheet feeding apparatus according to the claim **12**; and

an image forming portion which forms an image to the sheet fed from the sheet feeding apparatus.

* * * * *